Listing of CLAIMs

The listing of the claims below replaces all prior versions and listings of claims.

1-21. (Cancelled)

22. (Original) A mirror assembly for use in an optical scanner having a substantially vertical aperture and a substantially horizontal aperture, comprising:

a first set of pattern mirrors including at least primary and secondary mirrors, and at least one tertiary mirror;

a second set of pattern mirrors including at least primary, secondary, and tertiary mirrors;

a third set of pattern mirrors including at least primary and secondary mirrors;

wherein each of the primary mirrors of the first set being disposed to receive an incident light beam at an oblique angle to reflect the incident beam onto at least one of the secondary mirrors of the first set;

wherein each of the secondary mirrors of the first set being disposed to receive an incident light beam at an oblique angle to reflect the incident beam onto at least one of the tertiary mirrors of the first set;

wherein the tertiary mirror of the first set being disposed at an oblique angle with respect to an incident light beam from at least one of the secondary mirrors of the first set, and positioned to reflect the incident beam outwardly and downwardly through said substantially vertical aperture;

wherein each of the primary mirrors of the second set being disposed to receive an incident light beam at an oblique angle to reflect the incident beam onto at least one of the secondary mirrors of the second set;

wherein each of the secondary mirrors of the second set being disposed to receive an incident light beam at an oblique angle to reflect the incident beam onto at least one of the tertiary mirrors of the second set;

wherein each of the tertiary mirrors of the second set being disposed at an oblique angle with respect to an incident light beam from at least one of the secondary mirrors of the second set, and positioned to reflect the incident beam through said substantially

vertical aperture;

wherein each of the primary mirrors of the third set being disposed to receive an incident light beam at an oblique angle to reflect the incident beam onto at least one of the secondary mirrors of the third set;

wherein each of the secondary mirrors of the third set being disposed to receive an incident light beam at an oblique angle to reflect the incident beam through said substantially horizontal aperture;

wherein the primary mirrors of the first set include a plurality of generally trapezoidal mirrors;

wherein the secondary mirrors of the first set operate to receive a light beam from said generally trapezoidal mirrors; and

wherein the tertiary mirror of the first set is a generally trapezoidal mirror which operates to receive a light beam from said secondary mirrors of the first set.

23. (Original) A mirror assembly for use in an optical scanner having a substantially horizontal aperture and a substantially vertical aperture, comprising:

a first set of pattern mirrors including at least primary and secondary mirrors, and at least one tertiary mirror;

a second set of pattern mirrors including at least primary, secondary, and tertiary mirrors;

a third set of pattern mirrors including at least primary and secondary mirrors;

a source of light beams;

wherein the primary mirrors of the first set are disposed at oblique angles with respect to an incident light beam from said source, to reflect the light beam onto the secondary mirrors of the first set;

wherein the secondary mirrors of the first set are disposed at oblique angles with respect to an incident light beam from said source, to reflect the light beam onto the tertiary mirror of the first set;

wherein the tertiary mirror of the first set is disposed at oblique angles with respect to an incident light beam from the secondary mirrors of the first set, and positioned to reflect light outwardly and downwardly through said substantially vertical

aperture;

wherein the primary mirrors of the second set are disposed at oblique angles with respect to an incident light beam from said source, to reflect light onto the secondary mirrors of the second set;

wherein the secondary mirrors of the second set are disposed at oblique angles with respect to an incident light beam from said source, to reflect light onto the tertiary mirrors of the second set;

wherein the tertiary mirrors of the second set are disposed at oblique angles with respect to an incident light beam from the secondary mirrors of the second set, and positioned to reflect light outwardly through said substantially vertical aperture;

wherein the primary mirrors of the third set are disposed at oblique angles with respect to an incident light beam from said source, to reflect light onto the secondary mirrors of the third set;

wherein the secondary mirrors of the third set are disposed at oblique angles with respect to an incident light beam from the primary mirrors of the third set, and positioned to reflect light outwardly through said substantially horizontal aperture;

wherein the primary mirrors of the first set include a plurality of generally trapezoidal mirrors;

wherein the secondary mirrors of the first set operate to receive a light beam from said generally trapezoidal mirrors; and

wherein the tertiary mirror of the first set is a generally trapezoidal mirror which operates to receive a light beam from said secondary mirrors of the first set.

24. (Original) An optical scanner for scanning the surfaces of an object by means of light beams from a substantially vertical aperture and a substantially horizontal aperture, comprising:

a housing having said substantially vertical and horizontal apertures;

a rotating mirror polygon positioned at a predetermined location within an area in said housing;

at least first, second, and third sets of pattern mirrors located within the housing along the periphery of said area;

said first set of pattern mirrors being located in one region along said periphery, and having primary and secondary mirrors, and at least one tertiary mirror for reflecting light beams outwardly and downwardly through said substantially vertical aperture;

said second set of pattern mirrors being located in a similar region along said periphery, and having primary, secondary, and tertiary mirrors for reflecting light beams outwardly through said substantially vertical aperture;

said third set of pattern mirrors being located in a different region along said periphery, and having primary and secondary mirrors for reflecting light beams through said substantially horizontal aperture;

wherein the primary mirrors of the first set include a plurality of generally trapezoidal mirrors;

wherein the secondary mirrors of the first set operate to receive a light beam from said generally trapezoidal mirrors; and

wherein the tertiary mirror of the first set is a generally trapezoidal mirror which operates to receive a light beam from said secondary mirrors of the first set.

25. (Original) An optical scanner as in claim 24, in which said rotating mirror polygon produces light beams that pass radially outward therefrom to scan the primary mirrors of the first set of pattern mirrors, one after another, to scan the primary mirrors of the second set of pattern mirrors, one after another, and to scan the primary mirrors of the third set of pattern mirrors, one after another.

26. (Original) An optical scanner as in claim 24, in which said rotating mirror polygon reflects light beams onto the primary mirrors of said first, second, and third sets of pattern mirrors as it rotates.

27. (Original) An optical scanner as in claim 24, in which said rotating mirror polygon reflects light onto the primary mirrors of said first, second, and third sets of pattern mirrors.

28. (Original) A mirror assembly for use in an optical scanner having a substantially vertical aperture and a substantially horizontal aperture, comprising:

a first set of pattern mirrors including at least primary and secondary mirrors, and at least one tertiary mirror;

a second set of pattern mirrors including at least primary, secondary, and tertiary mirrors;

a third set of pattern mirrors including at least primary and secondary mirrors;

a source of light;

the primary mirrors of the first set being disposed at oblique angles with respect to the source of light, to reflect the source of light onto the secondary mirrors of the first set;

the secondary mirrors of the first set being disposed at oblique angles with respect to incident light beams from the primary mirrors of the first set, and positioned to reflect the light beams onto the tertiary mirror of the first set;

the tertiary mirror of the first set being disposed at oblique angles with respect to incident light beams from the secondary mirrors of the first set, and positioned to reflect the light beams outwardly and downwardly through said substantially vertical aperture;

the primary mirrors of the second set being disposed at oblique angles with respect to the source of light, to reflect the source of light onto the secondary mirrors of the second set;

the secondary mirrors of the second set being disposed at oblique angles with respect to the source of light, to reflect the source of light onto the tertiary mirrors of the second set;

the tertiary mirrors of the second set being disposed at oblique angles with respect to incident light beams from the secondary mirrors of the second set, and positioned to reflect the light beams outwardly through said substantially vertical aperture;

the primary mirrors of the third set being disposed at oblique angles with respect to the source of light, to reflect the source of light onto the secondary mirrors of the third set;

the secondary mirrors of the third set being disposed at oblique angles with respect to the source of light, to reflect the source of light beams through said

substantially horizontal aperture; and

the primary mirrors of the first set including two pairs of opposite side mirrors.

29. (Original) A mirror assembly as in claim 28, wherein

the secondary mirrors of the first set include opposite groups of three mirrors, wherein each secondary mirror operates to receive a light beam from one of the primary mirrors of the first set.

30. (Original) A mirror assembly as in claim 28 in which

at least two of the secondary mirrors of the first set operate to receive a light beam from a common primary mirror of the first set.

31. (Original) An optical scanner as in claim 28, in which

the source of light includes a rotating mirrored surface that directs light onto the primary mirrors of said first, second, and third sets of pattern mirrors as it rotates.

32. (Original) An optical scanner as in claim 28, in which

the source of light includes a rotating polygon with mirrors on each its sides to reflect light onto the primary mirrors of said first, second, and third sets of pattern mirrors.

33-40. (Cancelled)

41. (Previously amended) An optical scanner comprising:

a housing having a substantially vertical surface containing a first aperture and a substantially horizontal surface containing a second aperture;

a single laser which produces a laser beam within the housing;

a plurality of groups of pattern mirrors;

a polygon spinner having mirrored facets for reflecting the laser beam to produce a single reflected beam in a plurality of directions as the spinner rotates to cause the beam to strike at least some of the pattern mirrors, to produce a plurality of scanning beams

including a first group of scanning beams, a second group of scanning beams, and a third group of scanning beams; and

a first group of pattern mirrors including a first, second and third subsets of pattern mirrors for reflecting the first group of scanning beams through the first aperture to produce a first scan pattern consisting of a plurality of intersecting scan lines,

a second group of pattern mirrors including a first, second and third subsets of pattern mirrors reflecting the second group of scanning beams through the first aperture to produce a second scan pattern consisting of a plurality of intersecting scan lines; and

a third group of pattern mirrors for reflecting the third group of scanning beams through the second aperture to produce a third scan pattern consisting of a plurality of intersecting scan lines;

the first group of scanning beams reflecting off multiple mirrors of the first subset of pattern mirrors of the first group to the second subset thereof, then reflecting off multiple mirrors of said second subset to the third subset thereof, and then off at least one mirror of said third subset out the first aperture;

the second group of scanning beams reflecting off multiple mirrors of the first subset of pattern mirrors of the first group to the second subset thereof, then reflecting off multiple mirrors of said second subset to the third subset thereof, and then off at least one mirror of said third subset out the first aperture;

the first subset of mirrors of the first group include a plurality of generally trapezoidal mirrors;

the second subset of mirrors of the first group operate to receive a light beam from said generally trapezoidal mirrors; and

the third subset of mirror of the first group is a generally trapezoidal mirror which operates to receive a light beam from said second subset mirrors of the first group.

42. (Previously presented) An optical scanner as in claim 41, wherein

the third subset of mirrors in the second group includes multiple mirrors and the scanning beams from the second subset of the second group reflect off multiple mirrors of the second group and then pass out the first aperture.

43. (Currently amended) An optical scanner comprising:

a housing having a substantially vertical surface containing a first aperture and a substantially horizontal surface containing a second aperture;

a single laser which produces a laser beam within the housing;

a plurality of groups of pattern mirrors;

a polygon spinner having mirrored facets for reflecting the laser beam in a plurality of directions as the spinner rotates to produce a plurality of scanning beams including a first group of scanning beams, a second group of scanning beams, and a third group of scanning beams; and

a first group of pattern mirrors including a first, second and third subsets of pattern mirrors for reflecting the first group of scanning beams through the first aperture to produce a first scan pattern consisting of a plurality of intersecting scan lines,

a second group of pattern mirrors including a first, second and third subsets of pattern mirrors reflecting the second group of scanning beams through the first aperture to produce a second scan pattern consisting of a plurality of intersecting scan lines, each of the subsets of the second group having multiple mirrors; and

a third group of pattern mirrors including a first and second subsets of pattern mirrors for reflecting the third group of scanning beams through the second aperture to produce a third scan pattern consisting of a plurality of intersecting scan lines;

the first subset of mirrors of the first group include a plurality of generally trapezoidal mirrors;

the second subset of mirrors of the first group operate to receive a light beam from said generally trapezoidal mirrors;

the third subset of mirrors of the first group is a generally trapezoidal mirror which operates to receive a light beam from said second subset of mirrors of the first group;

the first group of scanning beams reflecting off the first subset of pattern mirrors of the first group to the second subset thereof, then reflecting off said second subset to the third subset thereof, and then off said third subset out the first aperture,

the second group of scanning beams reflecting off the first subset of pattern mirrors of the first group to the second subset thereof, then reflecting off said second subset to the third subset thereof, and then off said third subset out the first aperture,

at least one of the mirrors of the first group of pattern mirrors being positioned adjacent the first aperture to reflect certain of the first group of scanning beams outwardly through the first aperture to scan the side of an article,

at least one of the mirrors of the second group of pattern mirrors being positioned adjacent the first aperture and angled to reflect certain of the first group of scanning beams outwardly and laterally through the first aperture toward the leading side of the article, and at least one positioned adjacent the first aperture and angled to reflect certain of the first group of scanning beams outward and laterally through the first aperture to scan the trailing side of the article, and

at least one of the mirrors of the first group of pattern mirrors being positioned adjacent the first aperture and angled to reflect certain of the first group of scanning beams downwardly and outwardly through the first aperture to scan the top of the article.

44-45. (Cancelled)

46. (Previously amended) A method of scanning an item having a bar code from multiple directions, comprising the steps of

generating laser light;

providing a single multi-faceted mirrored polygon in a path of said laser light;

rotating the mirror polygon and directing the laser light at the polygon, as it is rotating, to produce a single laser beam reflected off each facet of the polygon;

generating a first group of scanning beams, a second group of scanning beams, and a third group of scanning beams by reflecting said laser light off said mirror polygon and then reflecting the laser beam off groups of pattern mirrors;

generating the first group of scanning beams comprises directing the laser beam to a first set of generally trapezoidal pattern mirrors, reflecting the beam from those mirrors to a second set of generally trapezoidal pattern mirrors and reflecting the beam from those mirrors to at least one additional generally trapezoidal pattern mirror;

directing said first group of scanning beams from said at least one additional mirror through a first transparent member oriented in a first plane to scan a surface of the item from one orthogonal direction to scan at least the top of an item;

generating the second plurality of scanning beams comprises directing the laser beam to a third set of pattern mirrors, reflecting the beam from those mirrors to a fourth set of pattern mirrors and reflecting the beam from those mirrors to a fifth set of pattern mirrors;

directing said second group of scanning beams from at least one mirror of said fifth set of mirrors directly outwardly through the first transparent member oriented in the first plane to scan one side of the item and from further mirrors of said fifth set of mirrors diagonally outwardly through the first transparent member oriented in the first plane to scan the item from a diagonal direction to scan the leading and trailing sides of the item; and

generating the third plurality of scanning beams comprises directing the single laser beam to a sixth set of pattern mirrors, reflecting the beam from those mirrors to a seventh set of pattern mirrors and reflecting the beam from the mirrors of the seventh set,

directing said third group of scanning beams from said seventh set of mirrors through a second transparent member oriented in a second plane orthogonal to said first plane to scan the item from another orthogonal direction to scan at least the bottom of the item.

47. (Previously presented) A method of scanning as in Claim 46 wherein

the first group of scanning beams is directed through the first transparent window in an outwardly and downwardly direction to scan the top of the item, and

the second group of scanning beams is directed through the first transparent window in at least a diagonally rearward direction and a diagonally forward direction to scan the leading and trailing sides of the item.

48. (Previously presented) A method of scanning as in claim 47 wherein certain of the beams of the second group are directed through the first transparent window in a diagonally rearward direction to scan the leading side of the item, other

beams of the second group are directed through the first transparent window in a diagonally forward direction to scan the trailing side of the item and other beams of the second group are directed outwardly through the first transparent window in a generally lateral direction to scan another side of the item.

49. (Previously presented) A method of scanning as in claim 46 where at least certain of the third group of scanning beams is generated by directing the beam from the polygon between mirrors of either the first or second set to the mirrors of the sixth set.

50. (Previously presented) A method of scanning as in claim 46 wherein scanning beams are directed through the first transparent window and through the second transparent window alternatingly, and this alternative operation occurs repeatedly, for beams originating from a single facet of the polygon, during each rotation of the polygon.

51. (Previously presented) A method of scanning as in claim 46 wherein generating laser light comprises generating a single laser beam, and only said single laser beam is reflected off each of the facets of the polygon.

52. (Previously amended) A method of scanning an item having a bar code from multiple directions, comprising the steps of

generating laser light in the form of a single laser beam;

providing a single multi-faceted mirrored polygon in a path of said single laser light beam;

rotating the mirror polygon and reflecting the single laser beam from each of the facets of the polygon, as the polygon is rotating, to form from the single laser beam a plurality of scanning beams that pass through both horizontal and vertical transparent members;

generating a first group of scanning beams, a second group of scanning beams, and a third group of scanning beams by reflecting said laser beam off said mirror polygon and then off groups of pattern mirrors;

generating the first group of scanning beams comprises directing the laser beam to a first set of generally trapezoidal pattern mirrors, reflecting the beam from those mirrors to a second set of generally trapezoidal pattern mirrors and reflecting the beam from those mirrors to at least one additional generally trapezoidal pattern mirror;

directing said first group of scanning beams from said at least one additional generally trapezoidal mirror through a vertical transparent member oriented in a first plane to scan a surface of the item from one orthogonal direction;

generating the second plurality of scanning beams comprises directing the laser beam to a third set of pattern mirrors, reflecting the beam from those mirrors to a fourth set of pattern mirrors and reflecting the beam from those mirrors to at least one further mirror;

directing said second group of scanning beams from said at least one further mirror through the vertical transparent member oriented in the first plane to scan the item from a diagonal direction to scan at least one side of the item; and

generating the third plurality of scanning beams comprises directing the laser beam to a fifth set of pattern mirrors, reflecting the beam from those mirrors to a sixth set of pattern mirrors and reflecting the beam from the mirrors of the sixth set,

directing said third group of scanning beams from said sixth set of mirrors through a horizontal transparent member oriented in a second plane orthogonal to said first plane to scan the item from another orthogonal direction.

53. (Previously presented) A method of scanning as in Claim 52 wherein

the first group of scanning beams is directed through the first transparent window in an outwardly and downwardly direction to scan the top of an item, and

the second group of scanning beams is directed through the first transparent window in a diagonally rearward direction to scan the leading side of an item.

54. (Previously presented) A method of scanning as in claim 53 wherein

certain of the beams of the second group are directed through the first transparent window in a diagonally rearward direction to scan the leading side of an item, and other

beams of the second group are directed through the first transparent window in a diagonally forward direction to scan the trailing side of an item.

55. (Previously presented) A scanner as in claim 52 wherein

scan lines are directed through the first transparent window and through the second transparent window alternatingly, and this alternative operation occurs repeatedly, for beams originating from a single facet of the polygon, during each rotation of the polygon.

56-92. (Cancelled)

93. (Previously presented) The mirror assembly as in claim 28 wherein the [first] second set of mirrors includes three tertiary mirrors.

94. (Previously presented) The mirror assembly as in claim 93 wherein at least two of the tertiary mirrors of the [first] second set of mirrors reflect light beams downwardly through the substantially vertical aperture.

95. (Previously presented) The mirror assembly as in claim 28 wherein the mirror assembly is for scanning bar codes on articles, and the light reflected downwardly through the substantially vertical window from the tertiary mirror[s] of the first set scans a bar code on the top surface of an article.

96. (Previously presented) The mirror assembly as in claim 95 wherein the light reflected downwardly produces beams that intersect one another.

97. (Previously presented) The mirror assembly as in claim 96 wherein the light beams from the substantially vertical aperture scan the top and customer side of the article, and the light beams from the substantially horizontal aperture scan the bottom of the article and its leading and trailing sides.

98. (Previously presented) The mirror assembly as in claim 28 wherein the mirror assembly includes at least six primary mirrors, at least five secondary mirrors and at least four tertiary mirrors said at least six primary mirrors reflecting light to said at least five secondary mirrors, and said at least five secondary mirrors reflecting light to said at least four tertiary mirrors.

99. (Previously presented) The mirror assembly as in claim 28 wherein the light source includes at least one laser, further including a mirrored polygon having at least three sides, each side having a mirrored surface and being disposed at an angle from the axis of the polygon different than the angle of the other two sides, and wherein the tertiary mirrors of the first and second sets of mirrors receive light that has been reflected from the mirrored polygon and produce at least six scan lines through the substantially vertical aperture during each rotation of the mirrored polygon.

100. (Previously presented) The mirror assembly as in claim 99 having just a single substantially vertical aperture and just a single substantially horizontal aperture, further including a housing having a first housing section and a second housing section connected at proximate ends forming a generally L-shaped structure, the substantially vertical aperture being located in the first housing section and the substantially horizontal aperture being located in the second housing section.

101. (Previously presented) The mirror assembly as in claim 98 wherein the source of light includes at least two lasers.

102. (Previously amended) An optical scanner comprising:

a housing having a substantially vertical surface containing a first aperture and a substantially horizontal surface containing a second aperture;

a single laser which produces a laser beam within the housing;

a polygon spinner having mirrored facets for reflecting the laser beam in a plurality of directions to produce a plurality of scanning beams including a first group of scanning beams, a second group of scanning beams, and a third group of scanning beams; and

a plurality of pattern mirrors, including a plurality of groups of pattern mirrors, for reflecting the first group of scanning beams through the first aperture to produce a first scan pattern consisting of a plurality of intersecting scan lines, for reflecting the second group of scanning beams through the first aperture to produce a second scan pattern consisting of a plurality of intersecting scan lines, and for reflecting the third group of scanning beams through the second aperture to produce a third scan pattern consisting of a plurality of intersecting scan lines;

wherein the pattern mirrors include

a first group of generally trapezoidal mirrors for reflecting the laser beam from the spinner;

a second group of generally trapezoidal mirrors for reflecting the laser beam from the first group of mirrors, including at least one mirror positioned and angled to reflect an incident beam in a substantially vertical direction to scan the bottom of an article and at least one mirror is positioned and angled to reflect an incident beam rearwardly to scan the forward side of the article; and

a third group of generally trapezoidal mirrors for reflecting the laser beam from some of the mirrors in the second group of mirrors.